PLEASE CIRCULATE AMONG THOSE INTERESTED, ESPECIALLY THOSE ACCUSTOMED TO MAKE SORGHUM SIRUP.

CIRCULAR LETTER

FROM THE

COMMISSIONER OF AGRICULTURE

RELATIVE TO THE

MANUFACTURE

OF

MAIZE AND SORGHUM SUGARS.

W HINGTON:
GOVERNME. T PRINTING OFFICE.
1879.

CIRCULAR-LETTER FROM THE COMMISSIONER OF AGRICULTURE RELATIVE TO THE MANUFACTURE OF SORGHUM SUGAR.

DEPARTMENT OF AGRICULTURE,
August 4, 1879.

This Department is especially interested in promoting the manufacture of sugar from whatever sources within our own country, and as the time for harvesting the sorghum crop has now arrived in many parts of the United States, the following circular for the information of the numerous correspondents writing us upon the subject is issued.

The development of this industry is of so much importance to the general welfare of the country that no effort will be spared to induce all persons provided with the apparatus necessary for manufacturing, to engage in experiments in this direction and to report the results, whether satisfactory or otherwise, to this Department.

The following detailed report of the Chemist, of the experiments made during the year 1878, is worthy of careful study:

Hon. G. W. LE DUC,
Commissioner of Agriculture:

SIR: I have the honor to submit the following tabulated results of recent experiments in the manufacture of sugar from the stalks of corn and sorghum.

The corn-stalks were from a common field-corn, said to have been a cross between a yellow and white. The ears had been plucked from the stalks and sold in our own markets as green corn some three weeks before the stalks had been cut and brought to me for the making of sugar.

The sorghum was a variety known as the Minnesota Early Amber. Both corn and sorghum were in a condition of vigorous growth when cut, the leaves being green.

The seed of the sorghum was sufficiently mature to warrant its preservation, and indeed the last lot received shelled slightly upon handling, The sorghum had not been planted or cultivated so as to produce even a fair average in size, as will be seen by the results appended.

The mill made use of in expressing the juice was an old sorghum-mill of common construction, which, through previous use and misuse, had been rendered quite unfit to give satisfactory results. After most of our experiments below given were concluded, it was repaired, so that afterward its working was very much better, as will be seen by the subsequent results given further on.

The apparatus used in the experiments, besides a few barrels and pails for holding the juice, consisted of a copper tank of the following dimensions: four feet three inches long; two feet three inches deep; two feet three inches wide; a galvanized iron pan nine feet long, eight inches deep, three feet six inches wide. This iron pan was surrounded by a wooden frame of two-inch plank, so as to support the sides, and each pan was placed in brick-work with chimney, and so arranged as to permit a fire to be kept below it in direct contact with the bottom. In the case of the copper tank the flame played about the sides also, so as to heat the contents more rapidly. The

galvanized-iron pan was such as could readily be constructed by any ordinary tinsmith or mechanic.

The copper tank was used for defecation with lime; the galvanized-iron pan for evaporation.

The process made use of in these experiments was in its essential features the one recently patented by Mr. F. L. Stewart, Murrysville, Westmoreland County, Pa., and which has been described in the report of the department for 1877.

The process in brief is as follows: After topping or stripping the corn or sorghum, it was passed through the mill, and when sufficient juice had been obtained it was heated in the copper tank to a temperature of 82° Centigrade—182° Fahrenheit. After the juice had reached this temperature there was added to it, with stirring, cream of lime until a piece of litmus paper dipped in the juice showed a purple or bluish-purple color. The heat was now raised to the boiling-point, and so soon as the juice was in good ebullition the fire was drawn, and a thick scum removed from the surface of the juice.

After a few minutes the sediment from the juice subsided, and by means of a syphon the clear liquid was decanted off, leaving a muddy sediment which was equal to about one-tenth to one-twentieth of the bulk of the juice. This muddy sediment was then drawn off by means of a stopcock, and filtered through a plaited-bag filter, and the clear filtrate therefrom was added to the liquid previously syphoned off.

The clarified juice which, during the above operation, is not allowed to cool below a temperature of 66° Centigrade, or 150° Fahrenheit, was now emptied into the evaporating pan, and there was added to it, with stirring, a solution of sulphurous acid in water, until the lime present was neutralized, as was shown by the reddening of litmus paper when it was dipped in the juice. The evaporation was now hastened as much as possible, and the juice concentrated to a sirup at a boiling-point of 108° Centigrade, equal to 226° Fahrenheit, or thereabout.

It was the intention to concentrate the sirup still more (to a boiling-point of 112° Centigrade, equal to 235° Fahrenheit), but it was found impracticable to do so in the evaporator, as the danger of scorching it was great, over a naked flame which could not well be controlled.

When the sirup reached the density above indicated, it was drawn off into wooden tubs, the fire having previously been drawn from beneath the evaporator.

Owing to the fact that each successive lot of stalks was a new experiment, I was unable to wait for the process of filtration of the sediment from the defecator to be completed, and therefore in every case lost a portion of the juice, which, of course, could have been saved in a continuous process such as would be practically carried out. This will explain what is meant by the juice utilized, as compared with that obtained.

It was intended to have still further concentrated the sirups in a smaller pan of galvanized iron, so arranged that by a slide the heat could be instantaneously removed to prevent the scorching of the sirup; but before this pan was completed it was found that the several tubs of sirup were crystallizing, and they were therefore allowed to stand, and the sugar was obtained by pressing out the molasses by means of an ordinary screw-press, the mass of molasses and sugar from the tubs being inclosed in an ordinary grain bag. The sugar thus obtained was very greatly improved in appearance by the addition of 5 or 10 per cent. of water, and stirring it into a mush, and again subjecting the mass to pressure, by which operation the adhering molasses was almost entirely removed, and the sugar obtained was, in the case of sorghum, nearly white, while in the case of corn it was of a rich golden yellow. I may add that in no case, either with corn or sorghum, did I fail to obtain satisfactory results in the way of crystallization, although, of course, the molasses still contains a very large percentage of crystallizable sugar, which will, at least in great part, be obtained by further concentration.

I omit mention of seven experiments with comparatively small quantities of corn-

stalks and sorghum, only saying that the results obtained were such as to fully warrant the more extended experiments here recorded, and it is unfortunate that the value of these experiments is vitiated somewhat by the imperfect apparatus employed, as also by the inferior material, which, however, was all that was obtainable in this vicinity. It is greatly to be desired that another season may find the department amply equipped with all necessary means to carry these important questions to a complete solution.

The points which these experiments have fully settled is, that there exists no difficulty in making from either corn or sorghum a first-rate quality of sugar, which will compare favorably with the best product from sugar-cane grown in the most favorable localities.

The experiments here given clearly indicate that sugar may be thus made at a profit, and it is desirable that nothing be spared in continuing an investigation giving such fair promise of success.

Results of experiments in the manufacture of sugar from maize and sorghum.

Number.		Pounds of raw stalks.	Per cent. of juice in raw stalks.	Pounds of juice used.	Specific gravity of juice.	Pounds of sirup made.	Per cent. of sirup in juice.
1	Corn-stalks, stripped and topped	2,353	25.29	520	1053	74	14.23
2	Corn-stalks, stripped and topped	2,769	23.91	597	1061	101	19.92
3	Corn-stalks (butt ends), stripped and topped	3,568	29.04	971	1053	142	14.62
4	Corn-stalks (top ends), stripped and topped	2,547	19.94	483	1050	65	13.46
5	Sorghum, stripped and topped	3,052	37.97	1,099	1057	146	13.29
6	Sorghum, stripped and topped	2,860	32.06	808	1057	135	16.71
7	Sorghum, topped, but unstripped	3,034	36.75	958	.....	148.5	15.50
8	Sorghum (butt ends), unstripped	1,324	47.49	445	1059	73	16.41
9	Sorghum (top ends), unstripped	1,322	43.16	398	1057	58.5	14.70
10	Sorghum (butt ends), unstripped	1,240	41.49	346	1062	57	16.47
11	Sorghum (top ends), unstripped	1,126	34.09	291	1059	41.5	14.26
12	Sorghum, small stalks, stripped	963	56.20	538	1086	102	18.95
13	Sorghum, large stalks, stripped	515	58.55	299	1091	60	20.00
14	Sorghum, small stalks, stripped	1,623	55.87	781	1086	156	19.97
15	Sorghum, large stalks, stripped	1,549	58.01	711	1084	158	22.22

In the experiments made with corn-stalks the stalks were invariably stripped, the tops being cut off at about the second joint. The percentage of stripped stalks, leaves, and tops is given in this table:

	Per cent. of stripped stalks.	Per cent. of leaves and tops.
No. 1	67.57	32.43
No. 2	68.69	31.31
Nos. 3 and 4	67.46	32.54
Average	67.91	32.09

In those cases where the sorghum was stripped and topped the following percentage of stripped stalks and of leaves and tops was obtained:

	Per cent. of stripped stalks.	Per cent. of leaves and tops.
No. 5	72.67	27.33
No. 6	72.55	27.45
Average	72.61	27.39

On account of the trouble in stripping the stalks, experiments were made with stalks unstripped, the tops alone being removed, and these experiments appear to prove that this troublesome operation of stripping may be avoided without any diminution of the amount of juice or of sugar obtained therefrom.

Below are the results obtained from stripped and unstripped sorghum, calculated to the raw stalks used.

By raw stalks is meant the stalks as they were cut in the field, leaves, tops, and all.

	Average per cent. of juice to raw stalks.	Average per cent. sirup in juice.
Stripped sorghum, Nos. 5 and 6	35.02	15.00
Unstripped sorghum, Nos. 7 to 11, inclusive	40.60	15.47

From the above it will be seen that not only was an increased amount of juice obtained, but that this juice gave an increased percentage of sirup, and there appears nothing unusual in the treatment of this juice from the unstripped cane, nor was there any appreciable difference in the readiness of the sirup to crystallize, nor in the character of the sugar finally obtained.

Although perhaps further experiments are desirable before considering this point as settled, it would appear from the above that not only was stripping unnecessary, but that it really involved a loss in the amount of sugar to be obtained; at least the above results indicate a difference of twenty per cent. increase in product in favor of the unstripped cane. It is not improbable that the above result is due to the fact that the leaves in passing through the mill tended to fill up the interstices between the compressed cane, and thus prevented the expressed juice from flowing through between the rolls with the bagasse. In case of discoloration by action of moisture or other causes, it will, however, be advisable, and probably necessary, to strip the stalks.

Several experiments were also made with both corn-stalks and sorghum to determine the relative value of the upper and lower half of the stalks, with the results given in the following table:

	Percentage of juice to stalks.	Specific gravity of juice.	Percentage of sirup in juice.
Corn stalks, butt ends, No. 3	29.04	1053	14.62
Corn stalks, top ends, No. 4	19.94	1050	13.46
Sorghum, butt ends, No. 8	47.49	1059	16.41
Sorghum, butt ends, No. 10	41.49	1062	16.47
Sorghum, top ends, No. 9	43.16	1057	14.70
Sorghum, top ends, No. 11	34.09	1059	14.26

It will be observed that Nos. 8 and 9 were the butts and tops of the same stalks, and were cut just after a rain, as were also Nos. 10 and 11, from which the rain had evaporated, and that the difference in yield of juice and sirup between butts and tops is nearly constant. The increase in specific gravity of the juice from butts over that from the top is also worthy of notice.

From the above table the conclusion from the average results is, that the proportion, by weight, of sugar in the lower half of the stalk is to the sugar in the upper half as follows: Corn butts to corn tops as 159 to 100; sorghum butts to sorghum tops as 131 is to 100. As will be seen by reference to the first table, the stalks of both corn and sorghum in the above experiment were divided almost equally by weight into butts and tops, so that the above proportion fairly represents the proportion of yield of sugar in the upper and lower half of the cane. There was a marked difference in the appearance of the juice as it flowed from the mill (that from the butts being lighter in color, especially in the experiments with corn), but after clarification no appreciable difference could be observed, nor was there any difference in the product except the quantitative one above mentioned, which was, however, a marked difference. Also, there was a marked difference in granulation in favor of the juice from the butts.

It is not improbable that a complete examination of the molasses obtained from these sugars may show a difference in composition, but at the present there has been no time to complete such analysis, and it seemed advisable no longer to withhold the report of what has been already determined.

Reference has been made to the very imperfect mill with which the juice was expressed in the above experiment. This will be obvious when we consider that both maize and sorghum contain a far greater per cent. of water even than we were able to obtain of juice, viz, from 75 to 85 per cent. of the weight of the plant; but it was thought best to continue the experiments even under these unfavorable conditions rather than lose a season which might be, at least, valuable in preparing us for work in the following one, under more favorable circumstances.

Some experiments were made with the mill which will illustrate the loss which, unquestionably, resulted. A small portion of millet (130 pounds of stripped stalks) was passed through the mill, and twenty-one and one-half pounds of juice obtained (equal to $16\frac{5}{10}$ per cent.). The bagasse was again passed through the mill without any adjustment of rolls (as that was then impossible), and seven and one-half pounds additional juice was obtained (equal to $5\frac{8}{10}$ per cent.) of the raw stalks. Besides, as was to have been anticipated, not only had we lost a large percentage of the juice, but it was altogether the better portion, *i. e.*, containing a much greater percentage of sugar. In this case the first portion of juice obtained from the mill had a specific gravity of 1061, while the second portion had a specific gravity of 1064. If now this difference in specific gravity of juice was proportional to the sugar contained in it, as is doubtless the case, the increase of juice obtained by the second pressure amounted to an increase of 37 per cent. over that obtained by the first pressure; and what was true of the millet operated upon was doubtless true of the sorghum and corn of the reported experiments Nos. 1 to 11 inclusive.

A similar experiment with a small lot of sorghum showed that 21 per cent. additional juice was obtained by again passing the bagasse through the mill.

These facts would seem to indicate a very important modification of the mills at present in use, viz, the introduction of an additional roller, which should subject the bagasse, as it passes through, to a repeated pressure, even if that pressure be no greater than that to which it has just been subjected.

But I am not left to conjecture what results would or might have been secured by a perfect mill, from these two small experiments above alluded to, with millet and sorghum; for at the conclusion of experiment No. 11 the mill was taken apart, and it was found that the bearings had been in some cases entirely worn away, so that no adjustment of pressure upon the rollers was possible. Upon providing new boxes, a series of four experiments were made with sorghum, the results of which are given below.

This sorghum was fully ripe, had been cut several days before putting through the mill, no green leaves were upon the stalks, and it was brought after several days of dry weather, so that the percentage of juice which it contained was comparatively low; but as is shown by the specific gravity and its yield in sirup, the increased yield from the mill after it was repaired was most decided and satisfactory.

I give below the results obtained in the four experiments alluded to, Nos. 12, 13, 14, and 15. By reference to the first table it will be seen that the average of juice obtained in experiments 12 to 15, inclusive, was 57.16 per cent. of the raw stalks, and that the percentage of sirup in this juice averaged 20.29.

The specific gravity of the juice averaged 10.87. We have, then, the result of a good mill, as compared with the one used in the first experiments, the following:

Mill.	Percentage of juice, unstripped stalks.	Specific gravity of juice.	Percentage of sirup and juice.
Old mill	48.96	1058	15.18
New mill	57.16	1087	20.29

By comparing the percentage of juice obtained and the specific gravity of the juice in the first and last experiments it will be seen that the former results are to the latter as 100 to 175; while if we compare the percentage of juice obtained and the percentage of sirup in the juice, the former experiments in their results are to the latter as 100 is to 156. This apparent discrepancy is due to the fact that when the latter experiments were made it was possible for me to carry the concentration of the sirup to a greater density than in the former cases, and hence a given amount of sirup in this latter case represents a far higher content of sugar than in the former; but these results clearly indicate that with a good mill results from 50 to 75 per cent. greater than those obtained in my experiments could be confidently relied upon.

The character of the maize and sorghum operated upon still remains for consideration. As has been already stated, the maize-stalks had been stripped of their ears three or four weeks before they were cut for the mill. It is much to be desired, and is contemplated in the further experiments to determine whether this was the time when their content of sugar was at the maximum. It is by no means improbable that had they been cut when the grain had begun to form, and was still in its milky state, that the product of sugar would have been greater. At least further experiments are needed to learn at what time the stalk may be most profitable as a sugar-producing plant.

Certain experiments upon record seem to establish the fact that, for one variety of corn at least, that period when the kernel is in the milky state is the time when the content of crystallizable sugar in the stalk is at its maximum. But this needs the confirmation of further experiments, since it is a matter of great importance. It is also by no means improbable that by careful selection, varieties of maize may be grown far surpassing any now known as sugar-producing plants. At the present, as in the past, all efforts in the cultivation of maize have tended in quite another direction, and with results very highly satisfactory. There is good reason to believe that certain varieties of sweet-corn may be found to yield a much greater amount of sugar than has been obtained from the common corn operated upon in the above experiments. (See Report Department of Agriculture, 1877, page 250.) But this remains a question for future determination, if means shall be provided to carry the experiments thus far made to a satisfactory conclusion.

It is also to be observed of the sorghum used in the above experiments, that it was by no means of such quality as would give the best results. Owing to thick sowing in drills, it had not secured full development; and although further experiments are necessary to determine the methods of cultivation which shall give the best results in product of sugar, there can be no question but that these conditions were far from having been attained in the sample made use of in the above experiments.

From a lot of nearly three tons the best fourth was selected, and the average weight of these stalks was, after being stripped, almost exactly one-half pound each—195 stalks, by actual count, weighed 100 pounds—while the three-fourths remaining gave an average of 530 stripped stalks to 100 pounds. There is, therefore, no one probably who would hesitate to believe that with an improved mill, and with properly grown cane, results fully 100 per cent. better than these published could readily have been secured.

The experiment with millet, already mentioned, gave very interesting results, and promises to be a new sugar-producing plant of considerable value. In this experiment, 130 pounds of stripped stalks, of the variety known as pearl millet, were passed twice through the mill, the first yield being 21½ pounds of juice, or specific gravity 1061, the second pressing giving 7½ pounds of juice additional, of specific gravity 1064. The total result was an amount of juice equal to 22.3 per cent. of the weight of stripped stalks.

By the treatment of this juice by the process already described, 24¾ pounds of juice yielded 2¾ pounds of sirup, which speedily crystallized, yielding an excellent sugar, which polarized 92°.

The amount of sugar thus obtained in the first crystallization was fifteen-sixteenths

pound, leaving a dark-colored molasses, which would doubtless yield an additional amount of sugar upon a second crystallization.

This experiment with millet, like those with sorghum and maize, was vitiated through the imperfection of the mill, but the character of the result attained certainly would demand further experiments with this plant, especially in consideration of the ease with which it is grown and the abundant yield to the acre.

An experiment was also made with a new grass from Guatemala, the Teosinte (*Euchlæna luxurians*), a coarse grass somewhat resembling maize in its habit. In the experiment, 316 pounds of stripped stalks which had suffered from a heavy frost, yielded 170 pounds of juice, of specific gravity 1022, or 53.8 per cent. of juice in stripped stalks. Of this juice, 134 pounds yielded 7¾ pounds of very good sirup in appearance, but it had a bitter taste, and contained no crystallizable sugar. The juice was very impure, but was very readily and completely clarified with lime; and although this experiment failed to show any crystallizable sugar, it was probably due to the frost to which the stalks had been subjected, and this plant will therefore receive further attention another season.

In the experiments with sorghum and maize it was mentioned that, owing to the want of a suitable vessel for concentrating the sirup, the proper degree of concentration which would secure the maximum amount of crystallization was not attained; but while awaiting the concentrating-pan it was found that crystallization had taken place in each one of the several lots of sirup, and it was therefore thought best to secure the first crop of sugar, and concentrate the sirup drained from these crystals. This was effected in the absence of a centrifugal machine, which would have facilitated the operation greatly, by squeezing out the sirup by means of a common press, the sirup and crystallized sugar being inclosed in a stout grain-bag.

This rude method not sufficing to remove the uncrystallized sirup wholly, and leaving the sugar-crystals adhesive from the small quantity of molasses remaining, a small quantity of water was added to the moist sugar, sufficient to dissolve some 5 per cent. of the sugar, and after stirring the mass about, and again subjecting it to pressure, the molasses was almost completely removed, and the sugar obtained in a most satisfactory condition in every respect, comparing most favorably with the best raw sugar of the market, as will be at once seen by reference to their very high polarization: Maize sugar, 90°; sorghum sugar, 94°; millet sugar, 92°.

Moreover, the quantity of sugar thus obtained, although much below the maximum, was in the case of experiment No. 10, with sorghum, equal to 34.6 per cent. of the weight of the sirup; in the case of the sorghum in experiment No. 6, to 31.3 per cent. of the sirup, while in the case of maize, in experiment No. 2, the amount of sugar thus obtained was 32 per cent. of the weight of the sirup. The sirup obtained by expressing it from these sugars still has a large quantity of crystallizable sugar, as is evident by the fact that they are again granulating rapidly, and they show a polarization of 36° for the maize sirup, and of 43° for the sorghum sirup.

Arranging, then, the results of these three experiments, Nos. 2, 6, and 10, we have the following results:

Experiment No. 10, with sorghum sirup, yielded 34.6 per cent. of sugar, polarizing 94°; 65.4 per cent. of sirup, polarizing 43.

Experiment No. 2, with maize sirup, yielded 32 per cent. of sugar, polarizing 90°; 68 per cent. of sirup, polarizing 36°.

Experiment No. 6, with sorghum sirup, yielded 31.3 per cent. of sugar, polarizing 94°; 68.7 per cent. of sirup, polarizing 43°.

In the other experiments varying results were obtained, owing to the reason already given, viz, the unequal degree of concentration of the sirups, and consequently a lesser product of sugar, but an increased product in sirup, which still contained a large amount of crytallizable sugar. Thus, in experiment No. 4, there was obtained 14.6 per cent. of sugar. In experiment No. 7 there was obtained 19.6 per cent. of sugar. In experiment No. 8 there was obtained 17.8 per cent. of sugar. In experiment No. 9 there was obtained 20.9 per cent. of sugar.

A small experiment, preliminary to those above recorded, was made with stalks of maize, and as it was within the means at the command of the laboratory, it was carried to a full conclusion, except only in this, that the stalks were cut in an ordinary hay-cutter, then beaten in a mortar. and the juice expressed by a small hand-press.

The amount of juice thus obtained was less in amount and poorer in quality than could have been obtained by the use of a good machine, but owing to the completeness of the results this small experiment has considerable value as indicating what may be done on a more generous scale and with the necessary appliances. In this experiment 28.18 pounds of raw stalks were taken, which gave of stripped stalks 19.08 pounds. From these stalks there were obtained 8.43 pounds of juice of a specific gravity 1065.

This juice, after clarification and evaporation, gave an excellent sirup, which was concentrated to a boiling point of 112° centigrade, equal to 234° Fahrenheit, and this sirup speedily crystallized, and yielded of excellent sugar .55 pound, and of molasses .28 pound.

According to the above result, one ton of raw stalks would have yielded of sugar 39.03 pounds, and of molassess 19.87 pounds.

As has been already said, there is no doubt but that a more thorough removal of the juice from the stalks would nearly, if not quite, have doubled the above yield, but the experiment is valuable as showing the facility with which a very large percentage of crystallizable sugar may be obtained from the sirup, amounting in this case to what would be regarded as an excellent result, even when working with sugar-cane, viz, almost exactly two-thirds the entire weight of sirup obtained as crystallized sugar in the first crop of crystals obtained from the sirup.

The above experiments, although confessedly far from being complete, have at least established the fact that there is no trouble in making sugar from corn and sorghum, and they have this merit also, that everything has been done quantitatively, so that each may see for himself where there is room for improvement, and can calculate with some degree of accuracy the probable yield per acre of these crops in sugar and the cost of manufacture.

An experiment was also made with a small lot of sugar-beets, received from F. D. Curtis, of Charlton, Saratoga County, New York, the object being to learn whether the process for the preparation of sugar from corn and sorghum, as above described, was applicable to beets; 14.5 pounds of sugar-beets were ground up, and 7.87 pounds of juice were expressed, having a specific gravity of 1080. This juice yielded a sirup which crystallized readily within twelve hours, and yielded .61 pound of sugar, which polarized 91°.7, and .58 pounds of sirup, from which an additional quantity of sugar may be doubtless obtained.

PETER COLLIER,
Chemist.

The following statement of Mr. Seth H. Kenny, published in a letter to the Pioneer Press, of Minneapolis, Minn., is the plain statement of a practical farmer of many years' experience, and needs no further comment:

To the Agricultural Editor of the Pioneer Press:

SIR: The past season cannot be called a good season for the Minnesota Early Amber cane, but the average yield was, as far as I have learned, 160 gallons of dense sirup to the acre. I have some figures which I will give by which, with the same capacity of machinery, a correct estimate may be had of the cost per gallon to manufacture. We usually begin operations to grind about September 1, but owing to the lateness of the season last year we did not commence until September 12. We finished October 28, and manufactured 4,242 gallons, nearly all of a density of 13¼ pounds per gallon. The time occupied in manufacturing this amount, including cleaning the evap-

orator each morning, was thirty days of eighteen hours each, or an average of 131 gallons to each eighteen hours. The help employed besides myself was five hands; two of these were boys.

I used two Climax mills, but see others do the same work with one Victor mill No. 5, which would make a saving of one hand, and a change of horses should take place every six hours.

In using the Stewart process, which I have not done except on a stove, it would need an additional plain pan for the juice and so elevated as to enable it to be drawn into the evaporator. The larger the machinery the cheaper the enterprise can be conducted. I have used No. 7 Cook evaporator for the past season and reduced the cost per gallon very much from two years since, when I used No. 5 evaporator. The amount of wood used last season was fifty-six cords of soft wood to make 4,242 gallons. The cost of raising one acre of cane, if the ground is plowed after it has become warm so that the weeds do not get the start of the cane, is the same as Indian corn, except first plowing around the hills, which costs about $3 per acre, with the additional cost of thinning to five or six stalks. The cost of stripping and hauling a quarter of a mile was $3 per acre.

Contract price that I paid for cane delivered at my mill was, per acre	$25 00
Horses for grinding corn, eighteen hours	3 75
Two men for boiling, eighteen hours	5 62
Two men for grinding corn, eighteen hours	3 74
Wood for one day	1 90
Cost for 141 gallons	40 01

One hundred and sixty gallons (average product per acre), estimating the cane at $25 per acre, would cost about 26 cents per gallon if you buy your cane. By raising the cane a large saving can be effected, as the cane can be raised much less than $17 per acre. For the unrefined product I have obtained 70 cents by the barrel for all sold. But it is evident that to make the Amber cane of most commercial value we must make our product into sugar.

Mr. Miller and I. and many others, have found that the Early Amber under certain conditions granulates readily, and under certain conditions drains easily but not always successfully, owing to impurities. I have found that with the aid received by Mr. Stewart's process I can greatly improve on the crude article, and from long experience in working cane I am so confident of success from the little I have seen that I shall surely adopt it next season. I would not do this if I had any doubts of success; but we have in my estimation the most favorable climate for the enterprise.

S. H. KENNY.

PIONEER PRESS, *Minneapolis, Minn., February* 3, 1879.

The statement of the Saint Paul Dispatch, published some time since, is reproduced, as it seems to have been carefully prepared and is a fair statement of the case in that State:

MINNESOTA EARLY AMBER SUGAR-CANE.

As this new industry has been so far mostly experimental, and these experiments were costly, the Dispatch has been a little cautious about indorsing statements made by enthusiasts in the business. The experimental season is not yet complete. Much has got to be learned before we know whether the business is profitable. There is no profit to the community in repeating statements without figures to back them up. This industry has arrived at a point where, if a success, capital must take it in hand. Men with money to invest will not touch this enterprise unless they see their way clear. In view of arriving at all the facts in the case obtainable in Minnesota, we

prepared a list of questions and submitted them to the most successful growers in the State.

We have received answers from four of the most reputable, verified by affidavits, as follows. When all agree one answer is given. When differing, they are numbered and each answer given.

How much seed is required to plant one acre?

Answer. Two pounds, either in hills or drills.

What is the cost of cultivating one acre?

No. 1. $3 more per acre than Indian corn. No. 2. Little more than Indian corn. No. 3. Cost of planting, $1; cultivating, $4.50. No. 4. Plowing, planting, and cultivating, $8.

What is the cost per acre of cutting and hauling to the mill?

No. 1. $6.75. No. 2. Hauling one hundred rods, $4.25. No. 3. $8. No. 4. $3.50.

What is the average diameter of an average stalk of cane?

No. 1. $\frac{7}{8}$ of an inch. No. 2. $1\frac{1}{8}$ inches. No. 3. $1\frac{1}{16}$ inches. No. 4. $1\frac{1}{4}$ to $1\frac{1}{2}$ inches.

What is the average length of a stalk of cane?

No. 1. 11 to 12 feet. No. 2. 11 feet. No. 3. 10 feet. No. 4. 8 feet after being topped.

How much raw juice per hundred pounds of cane?

No replies.

Density of raw juice by Beaumier saccharometer?

No. 1. 9 to 10. No. 2. $9\frac{1}{2}$ to 10. No. 3. 10.

Is the raw juice sour or neutral?

No. 1. Neutral. No. 2. Thinks it slightly acid. No. 3. Sweet. No. 4. Neutral but slightly acid.

At what season can crushing begin?

No. 1. Latter part of August. No. 2. September 1 to 10. No. 3. September 1. No. 4. August 25.

How long can the crushing season be prolonged?

No. 1. Until the cane freezes, usually in November. No. 2. No answer. No. 3. November 15. No. 4. 45 days; but by covering the cane to prevent freezing, it may be prolonged to 90 days.

At what price per hundred pounds can cane be delivered at the mill?

No. 1, 2, 3. No answer. No. 4. 18 cents per hundred pounds.

Can help always be had, and at what price per day?

No. 1. Preaches a sermon instead of answering question. No. 2. Plenty of help at $2.50 for boilers and $1.25 per day for laborers, including board. No. 3. Plenty of help at $1.50 per day, including board. No. 4. Plenty of help from $15 to $25 per month.

Can female help be used?

To some extent; perhaps 25 per cent. of the labor can be done by women.

What success in granulating the crop of 1878?

No. 1. Owing to frosts before the cane was matured, but little of the sirups are graining. No. 2. Made 49 barrels, which is now nearly all mush sugar. No. 3. Began working too late and does not expect to make sugar. No. 4. No reply.

What is the average yield per acre of sirup, and weight per gallon?

No. 1. 150 gallons, 12 pounds per gallon. No. 2. 160 to 170 gallons, 12 pounds of sugar per gallon. No. 3. 150 gallons. No. 4. 175 gallons.

What is the character of the soil on which your crop of cane was grown?

No. 1. Highly rolling timber land, with rich dark loam slightly mixed with sand; subsoil of yellow clay at a depth of about 12 inches from the surface. No. 2. Sandy loam with clay subsoil strongly impregnated with lime. No. 3. Heavy prairie loam, black and rich. No. 4. Sandy loam.

These questions are answered to the best of the ability of the persons giving them, and while they appear to agree in the main, yet they fall short of being sufficiently definite in many important particulars to form a positive opinion regarding the business or giving a basis upon which the capitalist may make his figures. The only

resource left appears to be to send competent chemists into the working districts next summer, and let them make experiments that will settle the question. Meanwhile let farmers grow all they need for their own use; club together and purchase machinery, and not run too much risk with large operations. Sirup will not pay unless it can be made to yield 60 per cent. of its weight in sugar. It will pay to grow the cane sufficient for your own use or to supply the home market, but do not expect to send it to a wholesale market and realize a profit, until the question of producing sugar is favorably demonstrated. All analysis of the juice of the Minnesota Early Amber cane shows that it is decidedly the richest in saccharine matter of any of the imphees or Chinese canes, and that if it pays to cultivate any cane of this class it will pay to cultivate this particular one. So far it has been quite prolific of sugar. The crop of 1877 nearly all showed a tendency to granulate. Eighteen hundred and seventy-eight was considered a bad year; still favorable localities show favorable results. The action of frost on cane before harvesting is fatal to granulation by any natural process.

Some chemists are at work compounding specifics to compel granulation in any imphee sirup. If they can do this we will be glad of it. There is time between now and the planting season for them to demonstrate their claims.

Scientific men must settle this question for us, and we have strong hopes that between now and April 1 their reports will be in the hands of the people, and that they will be favorable. We have increased faith with each new development that this industry will yet assume great proportions, and be a means of saving to our State the million dollars paid out annually in cash for sirups and sugars.—(From Saint Paul Dispatch, January, 1879.)

The following letter of Mr. F. L. Stewart, of recent date, concisely treats the whole subject, and is worthy of careful attention:

Briefly described, this process deals with saccharine juices containing in their normal conditions both cane and fruit sugars, the former largely preponderating. I recognize three distinct classes of saccharine juices, viz:

1. Those like the tropical sugar-cane and beet, which, when their juices are mature, contain, in association with other substances, true crystallizable sugar *only*.

2. Those, like most fruits, such as the apple and the grape, which whatever their composition otherwise, contain no true sugar, but only glucose, levulose, &c.

3. Those, like maize and sorghum, which have not heretofore been generally recognized as distinct, containing in their best condition both cane sugar and uncrystallizable sugar, but which by reason of the defective modes of treatment heretofore resorted to, have proved practically uncrystallizable.

These difficulties are now entirely removed. It is now clearly shown that the juices of maize and of sorghum grown in the United States are richer in sugar of the true cane type than any other plants that can be grown in temperate latitudes; that nine-tenths of their saccharine matter is such sugar, and that the impediments to crystallization are such as are peculiar to these plants.

Accordingly, I find that neither the processes adapted to the extraction of sugar from the Southern cane, nor the much more elaborate and costly methods of the beet sugar manufactures in Europe, are appropriate to the successful extraction of sugar from these plants, which, in this case, involves entirely new conditions and requires radical changes in the mode of chemical treatment.

Entirely aside from its advantages as an antiseptic and decolorizer, I have discovered a peculiar property in the dioxide of sulphur when employed upon these juices, under certain conditions, which, heretofore unknown and unused, now perfectly solves the problem of the separation and crystallization of the sugar. This is done expeditiously, cheaply, and certainly.

Practically, then, the value of these new sugar-producing plants may concisely be stated as follows:

1. The stems of Indian corn, in any of its many varieties, if taken at the proper

stage of development, as well as those of the different varieties of sorghum, contain in great abundance a saccharine juice scarcely excelled in richness by the sugar-cane of Louisiana. The sugar produced by this process is true crystallized cane sugar. Maize sugar, it need hardly be said, is not the so-called and comparatively worthless "corn sugar," sometimes made from the starch of the ripened grain by a well known chemical transformation; but it is a natural product of the juice of the immature plant. One hundred pounds of the stems of these plants at the proper period of their growth (when the grain is "in the milk" in the case of corn, and from shortly after the flowering period to perfect ripeness in the case of sorghum) contains about 87½ parts of juice and 12½ parts of woody fiber and insoluble substances; 12 to 15 per cent. of the juice is crystallizable cane sugar, nearly all of which can be extracted.

2. The impurities which hinder crystallization, as already said, are of a peculiar kind, and resist every other known mode of treatment except that used in this process. The sugar so made is of as good a quality as that made from the Southern cane or the beet, and is produced far more easily and cheaply.

3. Like the sugar-cane, and unlike the beet, these plants possess a saccharine quality of the juice, which is little affected by the presence of nitrogenous substances in the soil. Hence they are adapted to a wide range of soils, and notably those of the Western prairies where the beet is a failure.

4. All varieties of Indian corn and sorghum yield this saccharine juice, and natural hybridization does not greatly affect its quality, and hence but little care comparatively is needed to prevent the intermixture of varieties, although by careful selection richer varieties than those now existing will no doubt be produced.

5. The immature corn-plant only being used for this purpose the sugar may be produced within a little over three months from the time of planting the seed. Hence all danger of frost may be avoided even in our extreme Northern States, and generally the ground can be used for producing two crops in a season—a sugar crop, followed by turnips, &c. In these respects, as well as in many others, these plants have a great advantage over both the Southern cane and the beet. Some of the most prolific varieties of sorghum require but a little longer period to mature their juice than Indian corn.

6. The yield of sugar per acre from a single crop will range from 2,000 to 3,000 pounds, or equal to the average from the sugar-cane and the beet at their best, and at one-half the cost. The total cost of production, including the cultivation of the ground, the harvesting of the crop, manufacture, interest on machinery employed, chemicals, royalty, &c., should not exceed 2½ to 3 cents per pound. The yield of sugar from each gallon of dense sirup produced will vary from 9 to 11 pounds, averaging 10 pounds. The yield per acre of ground planted may therefore be roughly estimated by the known capacity of the land in any given locality to produce crude sorghum sirup in former years. Two hundred gallons of dense sorghum syrup, crystallizing 2,000 pounds (or a ton) of sugar per acre, is an easily attainable yield on good soil with good cultivation and proper crushing mills for expressing the juice. Of course where a crop of corn is planted for its sugar alone it must be grown much more densely on the ground than when the ripened grain is the object. For example, common field corn sown in drills so that the corn stems will stand 4 to 6 inches apart, the rows 3½ feet apart, yields on soil of medium quality an average of 250 lbs. of trimmed stems to each 100 feet in length of the rows, yielding to a properly constructed mill at least 66 per cent. (165 lbs.) of juice of specific gravity 1.057, of which 10 per cent. (or 16½ lbs.) of sugar is by this process easily extracted, or at the rate of over a ton of sugar to the acre of ground. In comparison with this the same kind of corn planted in rows the same distance apart, but in hills averaging 3 feet apart, and three stems to the hill, so that the grain may be fully developed in the "roasting ear" state, the yield of sugar will be only about one-half of that in the former case, or about 1,000 pounds per acre.

7. The hot summer climate of this part of North America is unequaled for the growth of these plants, as the exhibits at the late international exhibition at Phila-

delphia fully manifested, and the improved agricultural implements and methods now in use in maize culture will simplify and cheapen immeasurably its production.

8. If a combined sugar and grain crop is desired, the largest stemmed varieties of sweet corn should be grown. The grain may be cured by drying or canned when it is in the proper condition. But the ears of field corn may be removed before they harden, and fed to stock, either fresh or dried. There is scarcely any difference in the saccharine strength of the juice of "sweet" and field corn. Sorghum, however, yields more sugar than most varieties of sweet corn, on account of its much larger stems.

9. Great advantage is afforded in the manufacture of the new sugars, from the circumstance that the period of cutting and working up the crop into dense sirup occurs at a period when the season for outdoor work is most favorable, and when the days are long.

No loss is likely to result from inclemency of the weather. Furthermore, the process of manufacture, when carried on by this system, may safely be arrested at a point where it may be completed during the winter, when labor is cheap.

10. A large crop of blades and tops for fodder equal to hay, the ripened seed of the cane which when crushed is equal to oats, and the offal of the sugar factory for manure are supplementary to the sugar crop and very valuable.

11. By judicious treatment of the soil, returning to it regularly all that has been removed from it except the saccharine product, a sugar crop is the least exhaustive of all crops that can be grown, and improvement of the land is easy and certain. New lands are specially adapted to it.

12. The force of the various natural advantages possessed by these plants in the United States will be found to be greatly augmented by the circumstance that the departures from the old processes of manufacture now necessary to be adopted are all in the direction of greater *simplicity, cheapness,* and *ease of management* in accomplishing the result, the reverse of what the more complex nature of these juices would seem to indicate. It will be found, for example, that the cost of the manufacture of corn or sorghum sugar in this country can easily be reduced to *less than one-half the cost of the beet sugar manufacture in Europe; the carbonatation process and the use of animal charcoal being entirely dispensed with and the use of the vacuum pan being made unnecessary,* and not even desirable, except in the case of the largest central factories.

In concluding this brief summary of the main facts of this subject, I cannot but express the surprise which I have felt during the whole course of these researches, that during the century which has elapsed since our birth as a nation, no adequate conception has been reached of the true value of one of the commonest products of our soil—our native Indian corn.

The value of the process itself for the practical manufacture of sugar, independent of my own work, has been fully determined by the series of test experiments made with it at the Department of Agriculture last summer, under the direction of the Commissioner, by Professor Collier, and by intelligent farmers in the Western country, who were furnished by me with the chemicals and necessary information. In no case has there been a single failure. The experiments already made with the process at Washington alone fully "demonstrate," in the language of the Commissioner, "that there exist in these two plants a large amount of sugar which may readily be obtained, and that the aggregate amount possible from this source would be practically unlimited," and in the emphatic statement with which Professor Collier completes his special report that "the experiments have at least established the fact that there is no trouble in making sugar from corn and sorghum," and that "the sugars obtained were in a most satisfactory condition in every respect, comparing most favorably with the best raw sugar of the market, as will be seen at once by reference to their very high polarization—maize sugar 90°, sorghum sugar 94°, pearl, millet sugar 92°." (Report of Commissioner of Agriculture to the President, November, 1878, pp. 6, 18, and 19.)

For much fuller details in regard to this subject than it is possible for me to give in a hasty sketch like this, I take pleasure in referring you to the published proceed-

ings of the sugar growers' conventions recently held at Saint Louis, Mo., and Elmira, N. Y.; to the article entitled "Maize and Sorghum as Sugar Plants," contained in the last Annual Report of the Commissioner of Agriculture of the United States; to the hand-book of the process "Sugar made from Maize and Sorghum"; and to the very full and accurate report upon it by Hon. Victor Drummond, secretary to the British legation at Washington, published in London, 1879.

If the results already reached are accepted in their full significance, there can be no question that we are on the eve of a revolution in sugar manufacture and of the rise of a new and permanent industry in this country.

F. L. STEWART,
Murrysville, Westmoreland County, Pennsylvania.

Sorghum sugar has been granulated in small quantities in many places and from various kinds of sorghum, but more especially from Minnesota Early Amber cane, without the aid of any chemicals whatever; but Mr. Stewart claims that the juices of any kind of sorghum or maize may be readily granulated and much more sugar obtained by his process, which is here given and corrected as to the amount of cream of lime to be used:

1st. Heat the freshly-expressed juice of cane, sorghum, or maize in a copper or tinned-iron vessel to a temperature (as shown by a thermometer suspended so that the mercury bulb is immersed in the juice) of 180° Fahrenheit, equal to 82° Centigrade.

2d. After the juice has been heated to 180° Fahrenheit, add and stir into it 3 pints of lime to each 100 gallons of juice.

3d. After adding and stirring in the cream of lime, heat the juice rapidly to the boiling-point.

4th. When it begins to boil shut off the heat, or remove the vessel containing the juice from the fire, and so soon as the sediment begins to settle, draw off with a siphon (into tank as described in body of book) the clear liquid from the top until at least nine-tenths of the whole quantity of juice has been thus removed, leaving a thick muddy sediment at the bottom.

5th. Sweep out with a broom this muddy sediment into a bag-filter, and add the filtrate as it passes through the filter to the clear liquid siphoned off.

6th. To the clear liquid thus obtained in sections 4 and 5, and which should be allowed to cool to a temperature of 150° Fahrenheit (equal to 66° Centigrade) and not lower, there is now added of solution B one fluid ounce to each gallon of juice, or 5 to 7 pints to each 100 gallons of juice. At least enough of solution B is to be added to completely neutralize the lime in the juice; and to determine this point, a slip of blue litmus paper is dipped into the solution, when, if enough of solution B has been added, the blue color will be changed to red.

7th. Evaporate rapidly, skimming from time to time any scum which appears upon the surface, and adding solution B in small quantities if the boiling juice will not turn the blue litmus paper red.

8th. When the thermometer in the boiling juice indicates a temperature of 235° Fahrenheit (equal to 112° Centigrade) the sirup should be withdrawn from the fire, and it should be kept to crystallize in a room of about 80° Fahrenheit (equal to 27° Centigrade). To facilitate crystallization a few grains of granulated sugar may be added to the cooling sirup when it has reached a temperature of 100° Fahrenheit (equal to 38° Centigrade).

Answering our inquiries, Mr. Stewart sends the following additional particulars:

Sheet-drawings of finishing pan, heating tanks, crystallizing vessels, &c., enabling any one to have them built at very small cost. Mailed for 50 cents.

"Solution B," put up in iron-bound casks, holding about 50 gallons each, shipped by railroad from Chicago or Pittsburgh. Price (royalty included), 50 cents per gallon. Cheap freight rates secured when sent in large casks.

Chemical test paper, indispensable for this use. Twenty-five cents per pack, by mail, prepaid.

The red paper must be used in the heater; the blue in the defecating tank.

Heat the fresh juice to 180 degrees F.; stir into 100 gallons of it 3 pints of milk of lime; stir well; tear off a slip of the red paper and dip into it. If enough lime has been added, the color of the paper should instantly be changed to a deep blue. If the paper still retains a red or purple hue, stir in a little milk of lime until a dark blue only is produced. (Observe directions on page 101 of hand-book, except that only one-half the lime there recommended is to be used at first.)

After "Solution B" has been added in the lower tank, test the juice with the blue paper. If it changes the paper to a bright red, it is enough; if not, more solution B must be added to the juice before running it into the evaporator.

☞To accommodate those who wish to test the process in a preliminary way, I will ship the crystallizing "solution B," in 5 or 10-gallon casks, at 50 cents a gallon, charging 75 cents extra for the cask; or it will be put up in packages of one gallon each, and shipped by express, for $1. Orders filled by July 1, 1879. Please order early.

Orders can also be addressed "A. J. Russell, Manager, Crystal Lake Crossing, Ill."

F. L. STEWART,
Murraysville, Westmoreland County, Pa.

The following letter, addressed to Isaac A. Hedges, corresponding secretary of the Mississippi Valley Cane Growers' Association, is instructive and suggestive:

LA GRANGE, TEXAS, *June* 26, 1879.

DEAR SIR: I commenced grinding my amber cane on Monday, 16th; had about one acre that was ripe enough (seed in the dough). And right here let me say, that I had then never made nor helped to make a gallon of sirup in my life. I had much trouble getting my mill regulated; never did get it right on that lot of cane, and am satisfied I lost fully half of my juice; I have since got it right, though, and made a splendid lot of sirup out of some of the meanest cane I ever saw. The juice was only six Baumé, while my amber juice stood 9½ Baumé. I made the said sirup by the Stewart process. By some unaccountable delay my "Solution B," though shipped in ample time, did not arrive in time for the first of my crop, but only reached me so that I could use it on a little of the very last grinding, which I did in a hurried way, and it resulted in a thorough crystallization in thirty-six hours, which swung out through your centrifugal about eight pounds to the gallon of pretty good yellowish-brown sugar. But, as I said, I was in a hurry, night was closing in, we were all tired, and green, too, at this business, and we neglected or omitted several important things, not the least of which was settling. We did not wait for the juice to settle in the heating tank; in the cooler we poured it up and down with pans to make it cool faster (like fools), and thus prevent from settling there, and dump the hot molasses from the evaporator in buckets into the tilt-pan, and just rushed it right along to 235 degrees at railroad speed. If we had been doing our best to retain instead of remove impurities, I don't know what better course we could have pursued. Result: Sand in my sugar, which settled in the cup when used in coffee, though it is quite pretty to look at. Would send you samples, but knowing I can do much better, I prefer waiting a while. I only cut the ripest of my cane, leaving the other standing, and I will work that up now in about a week, and will let you know result. I made about 43 gallons of splendid sirup in all, and as I was scarce of seed at planting, I had to stepdrop them. They came up badly, and I only had about one-third of a stand on the

ground. I have seven acres more of same cane (Amber) that is just now heading out, but it was planted the same way; the stand was no better. My first cane was planted the 20th of March, and had just as well been planted the 20th of January, the time that many of us planted corn. Two full crops can be made here easy, and with proper management and early planting three crops are quite possible. I am planting again, and shall continue to replant the ground as fast as I cut the corn off until the middle, or perhaps the last, of August. My neighbors are carrying off the seed by the sackful, and planting all the unoccupied land they can find. The present prospect is that I will have more than I can do this fall running my mill night and day too. I send you a specimen cane by this mail; could not attend to it sooner.

With regards, I remain yours, truly,

HENRY B. RICHARDS.

ISAAC A. HEDGES, Esq.

The following letter is inserted to encourage other small farmers in the manufacture of sugar from true sugar-cane:

INDEPENDENCE, TANGIPAHOA PARISH, LOUISIANA,
December 24, 1878.

DEAR SIR: Have successfully grown sugar-cane and made sugar therefrom the past three years, making this year from 5 acres seven hogsheads and sixteen barrels molasses with a one-horse mill and a galvanized-iron-bottom plain evaporator, costing $20. There is not a foot of pine land in this State that cannot be made to do as well if not better by a moderate expenditure for manure. I used only stable manure. The above paragraph is forwarded, knowing you take a special interest in the production of sugar.

Would be pleased to receive from your department a few of the Early Amber sugar-cane for trial in this pine region, and if your department is short of correspondents will furnish from this parish with pleasure.

Very respectfully,

ROBERT LYNNE,
Independence, Tangipahoa Parish, Louisiana.

Hon. WM. G. LE DUC,
Commissioner of Agriculture.

HOPEWELL FURNACE, WASHINGTON COUNTY, MISSOURI,
January 20, 1879.

DEAR SIR: I hereby make the following report in regard to the culture of the Minnesota Amber sugar-cane seed that I received from the Agricultural Department. I planted about one-half acre on upland—second-year land—about the 20th of April. Drilled the seed, plowed three times, and hoed twice. I left seven or eight stocks in a place; by so doing the cane grew rather spindling. It would have done much better if I had only left from three to five stocks in a place. The cane commenced ripening about the 1st of August. We harvested it between the 5th and 10th. Made between thirty and forty gallons of very fine sirup—superior to anything that we ever made before out of any of the canes. We used the smallest-sized Pioneer mill and a plain sheet-iron evaporator. The water is sweeter than any of the other cane juices. Ten to eleven gallons of juice will make one gallon of sirup. The second crop grew rapidly, and would have made a half crop of sirup if we had pressed the cane, but we cut it for feed. It makes splendid feed for cattle and sheep. Unless the cows or ewes are near their dropping time, it is not safe to feed the seeds at that time, as it will cause abortion. Some few of my neighbors have tried it, and they all agree with

me in declaring that it is better adapted to our soil here than anything that has been tried in this county.

Respectfully,

H. C. THOMPSON.

Hon. WM. G. LE DUC,
Commissioner of Agriculture, Washington, D. C.

WAYLAND, ALLEGAN COUNTY, MICHIGAN,
January 15, 1879.

DEAR SIR: I have for some months past noted the statements of the Agricultural Department with reference to sugar from cane and corn stalks with a good deal of interest. In the early days of sorghum culture I had three years' experience in cultivating and manufacturing in Nebraska, and, from experiments at that time, I think I proved some points that may be of interest at the present time.

First. I satisfied myself that the sooner the cane is made up after it is ripe and cut, the better the quality of the sirup and the larger the percentage of sugar that will granulate.

Second. That no cold juice should be added to the evaporator after it comes to a boil. Large deep pans or evaporators are the best. The continuous-stream process lessens the chances of a granulating product from all ground-cane juice. The running of cold juice into hot at any stage of the reduction coagulates or sets the albuminous and waxy elements, so that it requires a filtering process to extract them.

Third. I found that the more the cane-stalk was shortened at both ends the better the quality of the sirup. The butt joints are barren of saccharine matter and give the sirup a bad taste, and the top joints are worthless.

Fourth. From experiments on a small scale, I think the best results can be obtained by steaming the cane and expressing the juice by screw pressure. The juice is then limpid and free from the waxy impurities that so much hinder granulation; also, the fine particles of cane that are ground out in crushing in a mill. Of the practicality of this plan or its economy on a large scale, I am not prepared to compare it with the old method as yet. I am convinced that the sugar interest of this country is one of the most important of our domestic economies, and, as such, commands national attention.

Yours, with respect,

C. E. DAVISON,
Secretary Wayland Township Agricultural Society.

Hon. WM. G. LE DUC,
Commissioner of Agriculture, Washington, D. C.

SUMNER, LAWRENCE COUNTY, ILLINOIS,
March 25, 1879.

DEAR SIR: I received three packages, of two sacks each, of the Early Minnesota Amber cane-seed. Was a little surprised to find it the same kind of seed that we have here by the name of Early Golden. It is a splendid variety; the best we have tried. * * * The boys used to get it (the seed) and parch it like corn. It would pop out white like pop-corn. * * * We have a new variety here called the Amber of Tennessee; but it is a late variety, and it is called Amber from the color of the head. It is a large cane, and, what we have tried of it, it yields well of a very nice light-colored sirup. We think it will be a valuable variety. The head is open and drooping, something like the White Imphee, only larger, and a bright amber-colored stalk, short jointed, like the Liberian, but larger. We shall test it further this year, and if it proves to be what it has done last year, it will be one of the best varieties for